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03.06.92 Bulletin 92/23(71) Applicant: **OLYMPUS OPTICAL CO., LTD.**
43-2, 2-chome, Hatagaya Shibuya-ku
Tokyo 151(JP)(72) Inventor: **Okada, Takao**

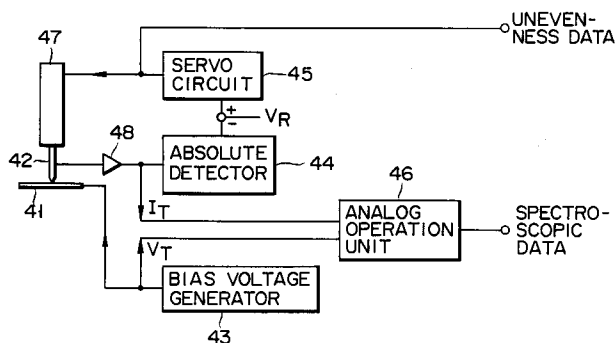
432-6, Dairakuji-machi
Hachioji-shi, Tokyo(JP)
Inventor: **Yagi, Akira**
4-10-3, Aihara, Sagamihara-shi
Kanagawa-ken(JP)
Inventor: **Morita, Seizo**
4-17-20, Takamatsu, Morioka-shi
Iwate-ken(JP)
Inventor: **Mikoshiba, Nobuo**
2-30-18, Yagiyamahoncho, Taihaku-ku
Sendai-shi, Miyagi-ken(JP)

(74) Representative: **KUHNEN, WACKER &**
PARTNER
Alois-Steinecker-Strasse 22 Postfach 1553
W-8050 Freising(DE)

(54) **Scanning tunneling spectroscopy and a spectroscopic information detection method.**

(57) A scanning tunnel spectroscopy comprises a generator (43) for applying a bias voltage (V_T) of a sin wave between a sample (41) and probe (42), an I-V converter (48) for converting a tunnel current flowing when the probe is set close to the sample, to a tunnel current representing voltage signal (I_T), a detector (44) for detecting the absolute value of the voltage signal (I_T), and a servo circuit (45) for servo-controlling a distance between the sample and probe using the absolute value with the servo time constant

set larger than five times the period of the bias voltage. The information concerning the unevenness of the sample is obtained based on an output of the servo control means. A unit (46) is provided for effecting the analog operation to derive a differential conductance based on the tunnel current on the real time basis and measuring the unevenness data and differential conductance data on the real time basis with the distance between the sample and probe kept constant.

**FIG. 8****EP 0 408 009 A3**



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,X	IBM JOURNAL OF RESEARCH AND DEVELOPMENT vol. 30, no. 4, July 1986, pages 411-416, New York, US; W.J. KAISER et al.: "Spec- troscopy of electronic states of metals with a scanning tunneling microscope" * the whole document *	10,18	G01N27/00
D,A	* idem *	1,12	
D,X	IBM JOURNAL OF RESEARCH AND DEVELOPMENT vol. 30, no. 4, July 1986, pages 355-369, New York, US; G. BINNIG et al.: "Scanning tunneling microscopy" * page 361, right-hand column - page 366, left-hand column *	11	
D,A	* idem *	1,10,12, 18	
D,X	PHYSICAL REVIEW LETTERS vol. 60, no. 12, 21 March 1988, pages 1166-1169, New York, US; B. MARCHON et al.: "Atomic arrangement of sulfur ada- toms on Mo(001) at atmospheric pressure: a scanning tunneling microscopy study"	11	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
D,A	* idem *	1,12	G01N G01B
A	REVIEW OF SCIENTIFIC INSTRUMENTS vol. 60, no. 3, March 1989, pages 301- 305, New York, US; J.P. PELZ et al.: "Extremely low-noise potentiometry with a scanning tunneling microscope" * page 302, right-hand column - page 303, left-hand column; figure 1 *	1-3, 8-10, 12-14, 16,17	
P,X	JOURNAL OF VACUUM SCIENCE AND TECHNOLOGY: PART A vol. A8, no. 1, February 1990, pages 336- 338, New York, US; A. YAGI et al.: "Dif- ferential conductance imaging under al-	1-4,6, 7,12-15	
The present search report has been drawn up for cl. 1-18			
Place of search BERLIN		Date of completion of the search 12.02.1991	Examiner K.M. JOHNSON
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

☒ LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-18
Apparatus and method for scanning
tunneling spectroscopy
2. Claims: 19-20
Current/voltage converting circuit

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,

namely claims: 1-18



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
P,A	ternate current tunneling bias" * the whole document * * idem *	5,10, 16,18	
O	FOURTH INTERNATIONAL CONFERENCE ON SCANNING TUNNELING MICROSCOPY/SPEC- TROSCOPY 9-14 July, 1989, Ibaraki, JP; A. YAGI et al.: "Differential conductance imaging under alternate current tunneling bias"	1-4,6, 7,12-15	
L	INSPEC DATABASE Institute of Electrical Engineers, London, GB * abstract no. A90074163 * The abstract shows that citation 5 is a report of a contribution made by YAGI et al. at the conference cited in 6		TECHNICAL FIELDS SEARCHED (Int. Cl. 4)